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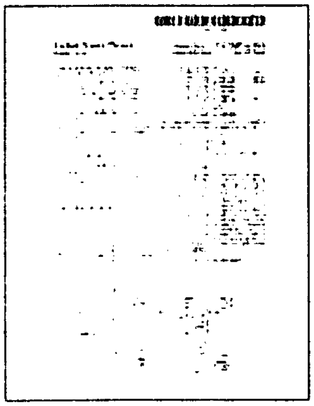
Time-based monitoring of service level agreements

Karen Ann Bradley et al

Patent summary



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Abstract | Drawing | Description | Claims

Abstract
A Time-Based Service Monitoring mechanism for monitoring Service Level Agreements (SLAs) over specific time intervals is described. To provide for the time-based monitoring of service, data is received for defining one or more tests for monitoring the level of network service that is being provided to a particular customer. Based on the received data, information is created and stored that defines a specific time range for when the one or more tests are to be enforced. The one or more tests are distributed to one or more agents that are configured to communicate with devices that are associated with the network. The devices are then configured to perform the one or more tests within the specific time range. Based on the results, the customer is provided information indicating whether they are receiving the level of service that has been guaranteed by the service provider over the specific time intervals.

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Inventors: Karen Ann Bradley, Christian Lemler, Amrit C. Patel, Ray Mein Lau
Assignee: Cisco Technology, Inc.
Primary Examiner: John

Claims

What is claimed is:

1. A network device configured for monitoring a level of network service provided by a service provider, comprising:

a network interface;
a processor coupled to the network interface and receiving information from the network interface;
a computer-readable medium accessible by the processor and comprising one or more sequences of instructions which, when executed by the processor, cause the processor to carry out the steps of:
receiving a schema that provides a configuration for monitoring a service level contract between the service provider and a particular customer, wherein the schema comprises:
data defining one or more metric tests for monitoring the level of network service being provided to the particular customer by the service provider, each said metric test measuring a level of service of a particular type of network operation, and including a set of one or more threshold values that define one or more particular performance metrics for the particular type of network operation, and
information defining a specific time range for when the one or more metric tests are to be performed; and
distributing the one or more metric tests to one or more agents, wherein the one or more agents configure devices associated with the network to perform the one or more metric tests during the specific time range and receive result information from the devices performing the one or more metric tests, wherein each of the one or more metric tests is selected from the group consisting of ICMP metric test, UDP metric test, DNS metric test, HTTP metric test and VoIP metric test.

2. The network device recited in claim 1, wherein the sequence of instructions further comprises instructions that cause the one or more processors to:

for each metric test defined in the schema,

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Current U.S. Classification
709/223; 709/224

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Citations

Patent Number	Title	Issue date
5488715	Process for integrated traffic data management and network surveillance in communications networks	Jan 30, 1996
5893905	Automated SLA performance analysis monitor with impact alerts on downstream jobs	Apr 13, 1999
5974237	Communications network monitoring	Oct 26, 1999
6269401	Integrated computer system and network performance monitoring	Jul 31, 2001
6304892	Management system for selective data exchanges across federated environments	Oct 16, 2001
6311175	System and method for generating performance	Oct 30, 2001

determine whether result information for that metric test is within the range of acceptable values defined by the set of one or more threshold values included with that metric test; and
create and store reporting information that indicates whether the customer is actually receiving, during the specific time range, the level of network service offered by the service provider in the service level contract, said reporting information based on said determinations.

3. The network device recited in claim 1,

said schema being based on Extensible Markup Language (XML), and wherein the schema models the service level contract.

4. The network device recited in claim 1, wherein the sequence of instructions further comprises the steps of:

generating, at a server, interface data for defining the schema for monitoring the service level contract; and
communicating the interface data to a client that is remote from said server, wherein the interface data allows users to configure specific times for monitoring the level of service that is being provided by the service provider, and to configure the set of one or more threshold values associated with each metric test.

5. The network device recited in claim 1, wherein:

the one or more agents configure the devices to perform the one or more metric tests only within the specific time range.

6. A method for monitoring a level of network service provided by a service provider, the method comprising the computer-implemented steps of:

receiving a schema that provides a configuration for monitoring a service level contract between the service provider and a particular customer, wherein the schema comprises:
data defining one or more metric tests for monitoring the level of network service being provided to the particular customer by the service provider, each said metric test measuring a level of service of a particular type of network operation, and

	models of complex information technology systems	
6336138	Template-driven approach for generating models on network services	Jan 1, 2002
6363053	Method and apparatus for measurement-based conformance testing of service level agreements in networks	Mar 26, 2002
6397359	Methods, systems and computer program products for scheduled network performance testing	May 28, 2002
6459682	Architecture for supporting service level agreements in an IP network	Oct 1, 2002
6466984	Method and apparatus for policy-based management of quality of service treatments of network data traffic flows by integrating policies with application programs	Oct 15, 2002
6584502	Technique for providing automatic event notification of changing network conditions to network elements in an adaptive, feedback-based	Jun 24, 2003

including a set of one or more threshold values that correspond to one or more particular performance metrics for the particular type of network operation, and information defining a specific time range for when the one or more metric tests are to be performed; and

distributing the one or more metric tests to one or more agents, wherein the one or more agents configure devices associated with the network to automatically perform the one or more metric tests during the specific time range, and receive result information from the devices performing the one or more metric tests, wherein each of the one or more metric tests is selected from the group consisting of ICMP metric test, UDP metric test, DNS metric test, HTTP metric test and VoIP metric test.

7. The method recited in claim 6, further including the steps of:

for each metric test defined in the schema, determining whether result information for that metric test is within the set of one or more threshold values included in that metric test; and

creating and storing reporting information that indicates whether the customer is actually receiving, during the specific time range, the level of network service offered by the service provider in the service level contract, said reporting information based on said determinations.

8. The method recited in claim 6,

said schema being based on Extensible Markup Language (XML), and wherein the schema models the service level contract.

9. The method recited in claim 6, further comprising the steps of:

generating, at a server, interface data for defining the schema for monitoring the service level contract; and

communicating the interface data to a client that is remote from said server, wherein the interface data allows users to configure specific times for monitoring the level of service that is being provided by the service provider, and to configure the set of one or more threshold values included with each metric test.

10. The method recited in claim 6, wherein:

	data network	
6687873	Method and system for reporting XML data from a legacy computer system	Feb 3, 2004
6701342	Method and apparatus for processing quality of service measurement data to assess a degree of compliance of internet services with service level agreements	Mar 2, 2004
6701345	Providing a notification when a plurality of users are altering similar data in a health care solution environment	Mar 2, 2004
6704883	Event-enabled distributed testing system	Mar 9, 2004

the one or more agents configure the devices to perform the one or more metric tests only within the specific time range.

11. A computer readable storage medium carrying sequences of instructions for monitoring a level of network service provided by a service provider, the sequences of instructions including instructions for performing the steps of:

receiving a schema that provides a configuration for monitoring a service level contract between the service provider and a particular customer, wherein the schema comprises:

data defining one or more metric tests for monitoring the level of network service being provided to the particular customer by the service provider, each said metric test measuring a level of service of a particular type of network operation, and including a set of one or more threshold values that define one or more particular performance metrics for the particular type of network operation, and

information defining a specific time range for when the one or more metric tests are to be performed; and

distributing the one or more metric tests to one or more agents, wherein the one or more agents configure devices associated with the network to perform the one or more metric tests during the specific time range and receive result information from the devices performing the one or more metric tests, wherein each of the one or more metric tests is selected from the group consisting of ICMP metric test, UDP metric test, DNS metric test, HTTP metric test and VoIP metric test.

12. The computer readable storage medium recited in claim 11, further comprising instructions for performing the steps of:

for each metric test defined in the schema, determining whether result information for that metric test is within the range of acceptable values defined by the set of one or more threshold values included with that metric test; and

creating and storing reporting information that indicates whether the customer is actually receiving, during the specific time range, the level of network service offered by the service provider in the service level contract, said reporting information based on said determinations.

13. The computer readable storage medium recited in claim 11, said schema being based on Extensible Markup Language (XML), and wherein the schema models the service level contract.

14. The computer readable storage medium recited in claim 11, further comprising instructions for performing the steps of:

> generating, at a server, interface data for defining the schema for monitoring the service level contract; and
> communicating the interface data to a client that is remote from said server, wherein the interface data allows users to configure specific times for monitoring the level of service that is being provided by the service provider, and to configure the set of one or more threshold values associated with each metric test.

15. The computer readable storage medium recited in claim 11, wherein: the one or more agents configure the devices to perform the one or more metric tests only within the specific time range.

16. A network device configured for monitoring a level of network service provided by a service provider, comprising:

> means for receiving a schema that provides a configuration for monitoring a service level contract between the service provider and a particular customer, wherein the schema comprises:
>> data defining one or more metric tests for monitoring the level of network service being provided to the particular customer by the service provider, each said metric test measuring a level of service of a particular type of network operations, and including a set of one or more threshold values that define one or more particular performance metrics for the particular type of network operation, and
>> information defining a specific time range for when the one or more metric tests are to be performed; and
>
> means for distributing the one or more metric tests to one or more agents, wherein the one or more agents configure devices associated with the network to perform the one or more metric tests during the specific time range and receive result information from the devices performing the one or more metric tests, wherein each of the one or more metric tests is selected from the group consisting of

ICMP metric test, UDP metric test, DNS metric test, HTTP metric test and VoIP metric test.

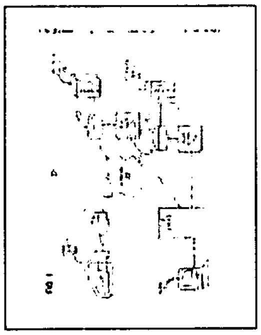
17. The network device recited in claim 16, further including:

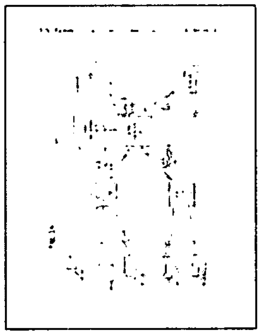
for each metric test defined in the schema, means for determining whether result information for that metric test is within the range of acceptable values defined by the set of one or more threshold values included with that metric test; and

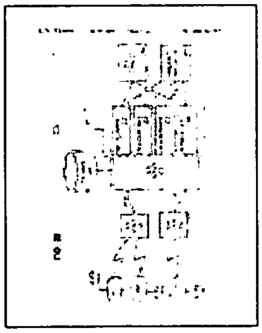
means for creating and storing reporting information that indicates whether the customer is actually receiving, during the specific time range, the level of network service offered by the service provider in the service level contract, said reporting information based on said determinations.

18. The method recited in claim 6, wherein the range of threshold values included with a particular metric test is configured according to a level of performance specified in a service level agreement for the type of network operation measured by the particular metric test.

Drawings







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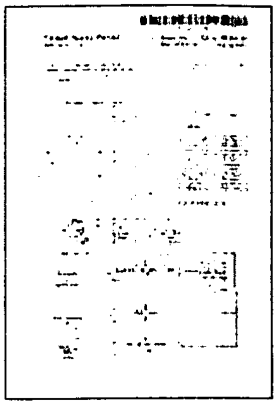
System and method for automated problem isolation in systems with measurements structured as a... Joseph L. Hellerstein et al

Patent summary



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Abstract | Drawing | Description | Claims

Abstract
A system and method are described for automating navigations in systems with measurement data that are structured as a multidimensional database (MDDB). The navigation includes an Automated Navigation Engine that uses external representations of a dimension selection function and a cube selection function to guide MDDB navigations. The method consists of the steps: (1) select the MDDB dimension that has the largest dimension selection score; (2) if this score is too small, terminate the method; (3) otherwise, select the cube with the largest cube selection score. These steps are performed repeatedly until (2) applies. Navigations can be performed for data mining, problem isolation, trending analysis, etc.

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Inventors: Joseph L. Hellerstein, Po Chang Yue
Assignee: International Business Machines Corporation
Primary Examiner: Linh M Pham

Current U.S. Classification
707/101

International Classification
G06F 1700; G06F 700

Claims

What is claimed is:

1. A system for obtaining information by automatically navigating measurement data that is structured into cubes comprising a plurality of dimensions, the system being associated with a multidimensional database component for specifying said cubes, said system comprising:

(a) a dimension selection component that quantifies information provided by navigating to a dimension;
(b) a cube selection component that quantifies the extent to which a cube provides information; and
(c) an automated navigation engine that uses the multidimensional database component, the dimension selection component and the cube selection component to automate navigations by iteratively selecting the best cube within successively selected cube dimensions to arrive at the cube having the desired information.

2. The system of claim 1 wherein said system is adapted to run at least one problem isolation application and wherein said navigations isolate problems.

3. The system of claim 1 wherein said navigations comprise mining of data stored in said database.

4. The system of claim 1 wherein said navigations comprise trending analysis.

5. A method for a system to automatically navigate measurement data for information gathering, wherein said measurement data is structured into a plurality of cubes comprising a plurality of dimensions, said method comprising the steps of:

(a) characterizing the information potential of said data for each of said plurality of dimensions;
(b) selecting the dimension having the greatest information potential based upon said characterizing;
(c) comparing the dimension information potential of said selected dimension to a

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Citations

Patent Number	Title	Issue date
5488725	System of document representation retrieval by successive iterated probability sampling	Jan 30, 1996
5918232	Multidimensional domain modeling method and system	Jun 29, 1999
5924090	Method and apparatus for searching a database of records	Jul 13, 1999
5940818	Attribute-based access for multi-dimensional databases	Aug 17, 1999
5943668	Relational emulation of a multi-dimensional database	Aug 24, 1999
5963936	Query processing system that computes GROUPING SETS, ROLLUP, and CUBE with a reduced number of GROUP BYs in a query graph model	Oct 5, 1999
6018736	Word-containing database accessing system for responding to ambiguous queries, including a	Jan 25, 2000

preset threshold;
(d) terminating the method if the dimension information potential for said selected dimension is less than said threshold;
(e) determining the cube information potential for at least one of said plurality of cubes within said selected dimension when said dimension information potential is not less than said threshold;
(f) selecting the cube within the selected dimension with the largest cube information potential, and
(g) iteratively selecting the best cube within successively selected cube dimensions by repeating steps (b) through (f) to arrive at the cube having the desired information.

6. The method of claim 5 wherein said characterizing comprises quantifying the information potential.

7. The method of claim 6 wherein said system has at least one associated dimension selection component for operating with a dimension selection function, and wherein said quantifying comprises computing a dimension selection score by said dimension selection function for each of said plurality of dimensions.

8. The method of claim 6 wherein said system has at least one associated cube selection component for operating with a cube selection function, and wherein said selecting said cube comprises computing a cube selection score by said cube selection function.

9. The method of claim 7 wherein said system further comprises at least one associated cube selection component for operating with a cube selection function, and wherein said selecting said cube comprises computing a cube selection score by said cube selection function.

10. The method of claim 9 wherein at least one of said cube selection function and said dimension selection function are externally specified.

11. The method of claim 8 wherein said cube selection function is externally specified.

12. The method of claim 7 wherein said dimension selection function is externally specified.

13. A method for providing automated problem isolation for a computer system adapted for detecting a problem, for gathering relevant

	dictionary of database words, a dictionary searcher and a database searcher	
6041326	Method and system in a computer network for an intelligent search engine	Mar 21, 2000
6094651	Discovery-driven exploration of OLAP data cubes	Jul 25, 2000
6108647	Method, apparatus and programmed medium for approximating the data cube and obtaining approximate answers to queries in relational databases	Aug 22, 2000
6134541	Searching multidimensional indexes using associated clustering and dimension reduction information	Oct 17, 2000

Referenced by

Patent Number	Title	Issue date
6980980	Summary-detail cube architecture using horizontal partitioning of dimensions	Dec 27, 2005

problem data, and for providing said data in a cube, comprising the steps of:

(a) obtaining an initial cube of relevant data from said computer system;
(b) selecting a cube dimension that best isolates the problem;
(c) comparing said selected cube dimension to a threshold;
(d) finding the best cube in said selected cube dimension when said selected cube dimension is not less than said threshold;
(e) repeating steps (b) through (d) until said selected cube dimension is less than said threshold.

14. The method of claim 13 further comprising the step of obtaining a dimension score function to control the granularity of said problem isolation.

15. The method of claim 13 wherein said finding the best cube in said selected cube dimension comprises the steps of:

(a) selecting a present dimension score;
(b) identifying a successive dimension in said cube;
(c) computing a successive dimension score for said successive dimension;
(d) comparing said successive dimension score to said present dimension score;
(e) replacing said present dimension score with said successive score when said successive score better isolates the problem;
(f) determining whether all dimensions have been analyzed; and
(g) repeating steps (b) through (f) until all dimensions have been analyzed.

16. The method of claim 15 further comprising applying at least one of a cube score function and a dimension score function for computing scores.

17. The method of claim 16 wherein at least one of said cube score function and said dimension score function is externally specified.

18. A program storage device readable by machine, tangibly embodying a program of instructions executable by the machine to perform method steps for a system associated with said machine to navigate measurement data for information gathering, wherein said measurement data is structured into a plurality of cubes comprising a plurality of dimensions, said method steps comprising:

(a) characterizing the information potential of said data for each of said plurality of dimensions;
(b) selecting the dimension having the greatest information potential based upon said characterizing;
(c) comparing the dimension information potential of said selected dimension to a preset threshold;
(d) terminating the method if the dimension information potential for said selected dimension is less than said threshold;
(e) determining the cube information potential for at least one of said plurality of cubes within said selected dimension when said dimension information potential is not less than said threshold;
(f) selecting the cube within the selected dimension with the largest cube information potential, and
(g) iteratively selectinq the best cube within successively selected cube dimensions by repeating steps (b) through (f) to arrive at the cube having the desired information.

19. The device of claim 18 wherein said characterizing comprises quantifying the information potential.

20. The device of claim 19 wherein said system has at least one associated dimension selection component for operating with a dimension selection function, and wherein said quantifying comprises computing a dimension selection score by said dimension selection function for each of said plurality of dimensions.

21. The device of claim 19 wherein said system has at least one associated cube selection component for operating with a cube selection function, and wherein said selecting said cube comprises computing a cube selection score by said cube selection function.

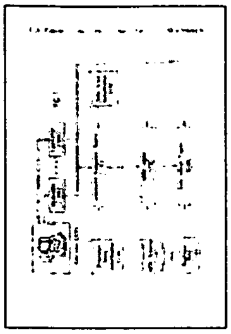
22. The device of claim 20 wherein said system further comprises at least one associated cube selection component for operating with a cube selection function, and wherein said selecting said cube comprises computing a cube selection score by said cube selection function.

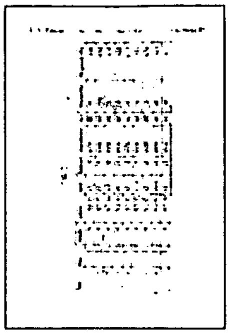
23. The device of claim 22 wherein at least one of said cube selection function and said dimension selection function are externally specified.

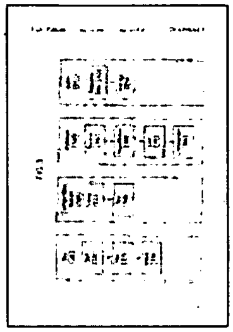
24. The device of claim 21 wherein said cube selection function is externally specified.

25. The device of claim 20 wherein said dimension selection function is externally specified.

Drawings







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